Lowell Regional Wastewater
451 First Street Boulevard
Lowell, MA 01854
Attn: Aaron Fox

August 6, 2019

Dear Mr. Fox,

Enclosed please find the toxicological evaluation and chemical analyses report for the effluent sample received on July 8th, 2019. This is your third quarter 2019 bioassay. Please call me at (401) 353-3420 if you have any questions.

Sincerely,

Michael McCallum
Technical Laboratory Director

NEW ENGLAND TESTING LABORATORY, INC.
59 Greenhill St., West Warwick, RI 02893
(401) 353-3420

TOXICOLOGICAL EVALUATION AND CHEMICAL ANALYSES OF EFFLUENT: NPDES Permit # MA0100633 Third Quarter 2019 Samples Lowell

Prepared For:
Lowell Regional Wastewater
451 First Street Boulevard
Lowell, MA 01854

August 6, 2019

By
New England Testing Laboratory, Inc.
59 Greenhill Street
West Warwick, RI 02893

NETLAB CASE NUMBER: 9G08023

New England Bioassay

A Division of GZA

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

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NEW ENGLAND BIOASSAY A DIVISION OF GZA
CHRONIC AQUATIC TOXICITY TEST REPORT

Permitee: Lowell RWWU NPDES # MA0100633
Report submitted to: New England Testing Laboratories
59 Greenhill Street, West Warwick RI
Sample ID: Effluent
Test Month/Year: July 2019
NEB Proj # 05.0044476.00

Test Type / Method: *Ceriodaphnia dubia* Modified Chronic Static-Renewal Freshwater Test Method 1002.0; EPA 821-R-02-013

Effluent Sample Dates: #1 7/7-8/19 #2 7/9-10/19 #3 7/11-12/19

Test Start Date: 7/9/19

Results Summary

Your results were as follows:

Passed all permit limits

Acute Test Results

Species	LC50	A-NOEC	Permit Limit	Pass / Fail
Ceriodaphnia dubia	>100%	100%	≥ 100%	Pass

Chronic Test Results

Species	C-NOEC	C-LOEC	IC25	Permit Limit	Pass/Fail
Ceriodaphnia dubia	100%	>100%	>100%	N/A	N/A

Data Qualifiers affecting this test:

Certifications & Approvals: NH ELAP (2071), NJ DEP (CT405)

Test Report Certification

Permittee name: Lowell RWWU Permit number: MA0100633

Client sample ID: Effluent Test Start Date: 7/9/19

Whole Effluent Toxicity Test Report Certification (Permittee)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: _____ _____

(Date) Authorized Signature

_____

Print or Type Name and Title

_____

Print or Type the Permittee's Name

MA0100633

Print or Type the NPDES Permit Number

Whole Effluent Toxicity Test Report Certification (Bioassay Laboratory)

The results reported relate only to the samples submitted as received

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: 8/5/19 _____

(Date) Kimberly Wills

Laboratory Manager

New England Bioassay a division of GZA

General Test Conditions

Permittee name: Lowell RWWU | Permit number: MA0100633

Client sample ID: Effluent | Test Start Date: 7/9/19

Sample Collection Information

Effluent #1 Dates/Times: 7/7-8/19 @ 0700-0700 Receiving Water #1 Date/Time: 7/8/19 @ 0930

Effluent #2 Dates/Times: 7/9-10/19 @ 0700-0700 Receiving Water #2 Date/Time: 7/10/19 @ 0930

Effluent #3 Dates/Times: 7/11-12/19 @ 0700-0700 Receiving Water #3 Date/Time: 7/12/19 @ _____

Were a minimum of three samples collected? Yes ☑ No ☐ *(see note below)

Were samples used within the first 36 hours of collection? Yes ☑ No ☐ * (see note below)

* sample collection note:

Test Conditions

Permittee's Receiving Water: Merrimack River

- Dilution water: Laboratory synthetic soft water (hardness 45 - 55 mg/L CaCO3)
- Control water: Receiving water collected at a point immediately upstream of or away from the discharge

Effluent concentrations tested: 0%, 6.25%, 12.5%, 25%, 50%, 100%

Was effluent salinity adjusted? No ☑ Yes ☐ with Instant Ocean sea salts to _____ ppt

Dechlorination procedures: Chlorine is measured using 4500 CL-G DPD Colorimetric Method

- Dechlorination was not required

TRC results and further information about aeration of samples can be found attached in "sample receipt chemistry"

Reference Toxicant Data

Ceriodaphnia dubia

Date: 7/1/19

Toxicant: Sodium chloride

Dilution Water: NEB CTRMH

Organism Source: NEB

Reproduction IC25: 1.05 g/L

Results within range Yes ☑ No ☐

Ceriodaphnia dubia Test Results

Permittee name: Lowell RWWU Permit number: MA0100633

Client sample ID: Effluent Test Dates: 7/9/19 - 7/17/19

Test Acceptability Criteria

Lab Diluent Survival:	100 %	Mean Lab Diluent Reproduction:	24.7 young per female
River Control Survival:	90 %	Mean River Control Reproduction:	22.0 young per female
Thiosulfate Control Survival:	N/A %	Mean Thiosulfate Control Reproduction:	N/A young per female

Presence of an asterisk (*) indicates EPA criteria was not met, see explanation in the "Results Discussion" section at the bottom of the following page.

Test Results

		Permit Limit	Test Result	Pass/Fail Status
Acute Data	48 hr LC50	≥ 100%	>100%	Pass
	48 hr NOEC		100%	
	TUa			
Chronic Data	Chronic LC50		>100%	
	Survival C-NOEC		100%	
	Survival C-LOEC		>100%	
	Reproduction C-NOEC		100%	
	Reproduction C-LOEC		>100%	
	Reproduction IC25		>100%	
	Reproduction IC50		>100%	
	Reportable C-NOEC		100%	
	Reportable C-LOEC		>100%	
	MATC		>100%	
	TUc			

Presence of an asterisk (*) indicates qualified data, see explanation in the "Results Discussion" section at the bottom of the following page.

Test Variability

Reproduction PMSD: 38.4% Upper & Lower EPA bounds: 13 - 47% ☐ Low ☑ Within bounds ☐ High

☐ PMSD exceeds upper bounds. Test results are highly variable and may not be sensitive enough to determine the presence of toxicity at the permit limit concentration (PLC)

☑ The PMSD falls within the upper (47%) and lower (13%) bounds. Results are reportable.

☐ PMSD falls below the lower bound test variability criterion. The test is very sensitive. The relative percent difference (RPD) between the control and each treatment was calculated and compared to the lower bound.

- ☐ The RPD values for all concentrations fall below the lower bound. Any differences observed in this test are considered statistically insignificant.
- ☐ Some of the concentrations that were flagged as statistically significant have RPD values that fall below the lower bound. Any differences observed in these concentrations will not be considered statistically significantly decreased from the control.
- ☐ No statistically significant reductions were observed in this test.

Ceriodaphnia dubia Test Results

Permittee name: Lowell RWWU Permit number: MA0100633

Client sample ID: Effluent Test Dates: 7/9/19 - 7/17/19

Concentration - Response Evaluation

Survival: #12 No significant effects at any test concentration with a flat concentration-response curve. Test concentrations performed very similarly to dilution control.

Reproduction: #12 No significant effects at any test concentration with a relatively flat concentration-response curve. Test concentrations performed both above and below (but similarly to) the dilution control.

The concentration - response relationship was reviewed and the following determination was made:

Survival	Reproduction	
X	X	Results are reliable and reportable
		Results are anomalous (see explanation below)
		Results are inconclusive - retest (see explanation below)

Results Discussion (if applicable):

TEST METHODS

Ceriodaphnia dubia

Test type:	Modified Chronic Static Renewal Freshwater Test
Test Reference Manual:	EPA-821-R-02-013 "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Freshwater Organisms"
Test Method:	*Ceriodaphnia dubia* Survival and Reproduction Test - EPA 1002.0
Temperature:	25 ˚C ± 1˚C (Temperatures should not deviate by more than 3˚C during the test) (required)
Light Quality:	Ambient Laboratory Illumination (recommended)
Light Intensity:	10-20 µE/m2/s, or 50-100 ft-c (recommended)
Photoperiod:	16 hours light, 8 hours dark (recommended)
Test chamber size:	30 mL (recommended minimum)
Test solution volume:	15 mL (recommended minimum)
Renewal of Test Solutions:	Daily (required)
Age of Test Organisms:	Less than 24 hours; and all released within a 8-h period (required)
Number of Neonates Per Test Chamber:	1 Assigned using blocking by known parentage (required)
Number of Replicate Test Chambers Per Treatment:	10 (required minimum)
Number of Neonates Per Test Concentration:	10 (required minimum)
Feeding Regime:	Fed 0.1 mL each of YCT and algal suspension per exposure chamber daily. (recommended)
Cleaning:	Use new plastic cups daily (recommended)
Aeration:	None (recommended)
Test Duration:	Until 60% or more of control females have three broods (maximum test duration 8 days) (required)
Endpoints:	Survival and reproduction (required)
Test Acceptability:	80% or greater survival of all control organisms and an average of 15 or more young per surviving female in the control solutions. 60% of surviving control females must produce three broods. (required)
Sampling Requirements:	Minimum of three samples with a maximum holding time of 36 hours before first use. (required)
Sample volume required:	1 L/Day (recommended)

CERIODAPHNIA DUBIA
DATASHEETS & STATISTICAL ANALYSIS

NEW ENGLAND BIOASSAY TOXICITY DATA FORM
CHRONIC COVER SHEET

CLIENT:	New England Testing Laboratories	*C.dubia* TEST ID #	19-886
ADDRESS:	59 Greenhill Street	CHAIN OF CUSTODY #	C39-2558/59
	West Warwick, RI 02893	NEB PROJECT #	05.0044476.00
PERMITTEE:	Lowell RWWU	SAMPLE ID:	Effluent
PERMIT NUMBER:	MA0100633		
DILUTION WATER:	Laboratory Soft Water		

INVERTEBRATES

TEST SET-UP TECHNICIAN:	CH
TEST SPECIES:	*Ceriodaphnia dubia*
NEB LOT #	Cd19 (RMH 142)
AGE:	< 24 hours
TEST SOLUTION VOLUME (mls):	15
ORGANISMS PER TEST CHAMBER:	1
ORGANISMS PER CONCENTRATION:	10

LABORATORY CONTROL WATER (SRCF)

Lot Number	Hardness mg/L $CaCO_3$	Alkalinity mg/L $CaCO_3$
C39-S015	50	35

	DATE	TIME
TEST START:	7/9/19	1125
TEST END:	7/17/19	1314

COMMENTS:

REVIEWED BY: DATE: 8/5/19

NEW ENGLAND BIOASSAY - CHRONIC TOXICITY TEST BROOD DATA SHEET

FACILITY NAME & ADDRESS:	Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850				
NEB PROJECT NUMBER:	05.0044476.00	NEB TEST NUMBER:	19-886	COC #	C39-2558/59
TEST ORGANISM:	*Ceriodaphnia dubia*	AGE:	<24 hours	Lot #	Cd19 (RMH 142)
START DATE:	7/9/19	TIME:	1125	END DATE:	7/17/19	TIME:	1314

Effluent Concentration	Day Number	Culture Lot# Cd19 (RMH 142) Replicate A	B	C	D	E	F	G	H	I	J	Total Live Young	# Live Adults	Analyst-Transfer	Analyst-Counts
	Cup #	B1	B2	B3	B4	B5	B6	B7	B8	B10	B11				
NEB Lab Synthetic Diluent	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	CH	
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	CW	
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	CH	
	3	5	6	6	5	5	3	7	6	5	6	54	10	CH	CH
	4	3	5	8	5	✓	✓	✓	1	✓	✓	22	10	CW	CW
	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10	CH	CH
	6	11	8	16	✓	9	2	1	14	10	5	76	10	KO	KO
	7	✓	17	✓	✓	✓	✓	18	22	11	✓	68	10	KO	KO
	8	✓	3	2	✓	✓	4	18	✓	✓	✓	27	10	CH	CH
	totals	19	39	32	10	14	9	44	43	26	11	247	10		MC
		A	B	C	D	E	F	G	H	I	J				
Merrimack River Control	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	4	5	1	3	✓	✓	4	2	6	4	29	10		
	4	8	✓	10	14	2	✓	5	8	✓	✓	47	10		
	5	✓	3	✓	✓	✓	9	✓	✓	✓/x	✓	12	9		
	6	19	5	7	11	16	3	14	3	X	4	82	9		
	7	~~4~~	1	12	~~16~~	6	11	~~16~~	11	X	1	42	9		
	8	~~2~~	✓	~~6~~	~~18~~	3	1	~~5~~	~~3~~	X	4	8	9		
	totals	31	14	30	28	27	24	23	24	6	13	220	9		
		A	B	C	D	E	F	G	H	I	J				
6.25%	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	5	✓	✓	✓	5	10	10		
	4	3	2	12	4	8	✓	6	4	6	5	50	10		
	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	6	4	7	12	✓	11	✓	12	1	4	2	53	10		
	7	2	7	18	17	4	✓	9	✓	5	2	64	10		
	8	3	2	~~8~~	7	5	7	2	✓	1	✓	27	10		
	totals	12	18	34	28	28	12	29	5	16	14	204	10		

Notes: Replicates in which the neonates are marked with a strike are judged to contain 4th broods (rather than split-broods), and the 4th brood is not included in the reproduction totals per EPA-821-R-02-013.

Adults producing no neonates were determined to be non-reproducing females at test termination.

NEW ENGLAND BIOASSAY - CHRONIC TOXICITY TEST BROOD DATA SHEET

FACILITY NAME & ADDRESS:	Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850		
NEB PROJECT NUMBER: 05.0044476.00	ORGANISM: *Ceriodaphnia dubia*	START DATE: 7/9/19	

Effluent Concentration	Day Number	Replicate A	B	C	D	E	F	G	H	I	J	Total Live Young	# Live Adults		
12.5%	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	✓	✓	✓	✓	5	✓	1	✓	1	7	10		
	4	8	5	2	✓	3	✓	10	10	2	10	50	10		
	5	✓	✓	✓	✓	✓	5	✓	✓	✓	✓	5	10		
	6	3	✓	1	1	2	9	3	3	6	12	40	10		
	7	12	11	9	12	4	4	5	5	3	~~9~~	74	10		
	8	✓	21	16	8	8	~~1~~	✓	~~6~~	1	✓	54	10		
	totals	23	37	28	21	17	23	18	19	12	32	230	10		
25%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	1	✓	6	2	1	4	1	1	4	4	24	10		
	4	10	6	10	10	8	✓	8	4	6	2	64	10		
	5	✓	✓	✓	✓	✓	9	✓	✓	✓	✓	9	10		
	6	9	4	15	✓	14	3	1	15	1	7	69	10		
	7	7	15	~~15~~	8	~~8~~	15	9	1	12	1	68	10		
	8	~~6~~	~~14~~	~~2~~	✓	~~3~~	~~11~~	~~9~~	✓	✓/x	~~2~~	0	9		
	totals	33	25	31	20	23	31	19	21	23	14	234	9		
50%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	✓	3	4	3	2	✓	5	1	5	5	28	10		
	4	✓	✓	10	10	4	✓	10	10	10	✓	54	10		
	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	6	10	9	14	5	9	✓	10	6	11	5	79	10		
	7	13	1	~~15~~	10	~~15~~	✓	~~17~~	7	~~19~~	8	39	10		
	8	✓	14	~~7~~	~~8~~	~~16~~	✓	~~12~~	~~11~~	~~11~~	13	27	10		
	totals	23	27	28	36	15	0	25	24	26	31	227	10		
100%		A	B	C	D	E	F	G	H	I	J				
	0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	10		
	3	5	4	5	✓	6	4	4	4	2	5	39	10		
	4	10	12	10	✓	12	✓	10	✓	10	10	74	10		
	5	✓	✓	✓	✓	✓	8	✓	✓	✓	✓	8	10		
	6	14	3	3	5	12	4	13	11	1	8	74	10		
	7	4	1	14	✓	~~12~~	7	~~9~~	8	11	5	46	10		
	8	~~7~~	~~12~~	~~2~~	9	~~11~~	~~6~~	~~8~~	12	~~13~~	~~9~~	21	10		
	totals	29	20	32	14	30	23	27	35	24	28	262	10		

Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	17-9196-2607	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Jul-19 10:15	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	10-0848-7679	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	09 Jul-19 11:25	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Receiving Water
Ending Date:	17 Jul-19 13:14	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Test Length:	8d 2h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	01-2346-1574	**Code:**	75BDFC6	**Project:**	
Sample Date:	08 Jul-19 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)
Receipt Date:	08 Jul-19 16:00	**CAS (PC):**		**Station:**	
Sample Age:	28h	**Client:**	New England Testing Labs		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X)	Linear	1307537	200	Yes	Two-Point Interpolation

Point Estimates

Level		95% LCL	95% UCL
LC50	>100	n/a	n/a

2d Survival Rate Summary — Calculated Variate(A/B) — Isotonic Variate

Group	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	D	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
50		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
100		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%

2d Survival Rate Detail

Group	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

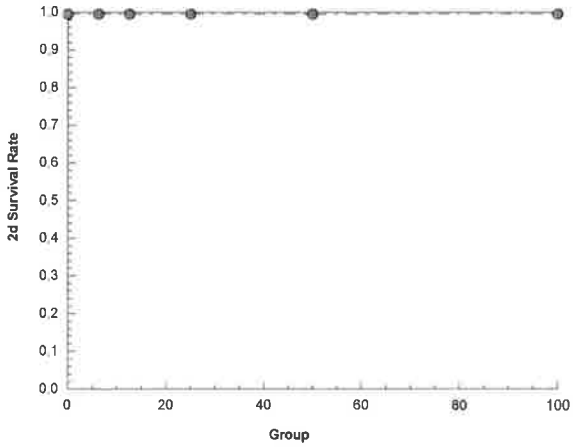
2d Survival Rate Binomials

Group	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	17-9196-2607	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Jul-19 10:15	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	16-2778-8707	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Jul-19 10:15	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	10-0848-7679	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	09 Jul-19 11:25	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Receiving Water
Ending Date:	17 Jul-19 13:14	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Test Length:	8d 2h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	01-2346-1574	**Code:**	75BDFC6	**Project:**	
Sample Date:	08 Jul-19 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)
Receipt Date:	08 Jul-19 16:00	**CAS (PC):**		**Station:**	
Sample Age:	28h	**Client:**	New England Testing Labs		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X)	Linear	308498	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	1	0.8	>>	Yes	Passes Criteria

Point Estimates

Level		95% LCL	95% UCL
LC50	>100	n/a	n/a

7d Survival Rate Summary — Calculated Variate(A/B) — Isotonic Variate

Group	Code	Count	Mean	Min	Max	Std Dev	CV%	%Effect	A/B	Mean	%Effect
0	D	10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
6.25		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
12.5		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	1	0.0%
25		10	0.9000	0.0000	1.0000	0.3162	35.14%	10.0%	9/10	0.9667	3.33%
50		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	0.9667	3.33%
100		10	1.0000	1.0000	1.0000	0.0000	0.00%	0.0%	10/10	0.9667	3.33%

7d Survival Rate Detail

Group	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

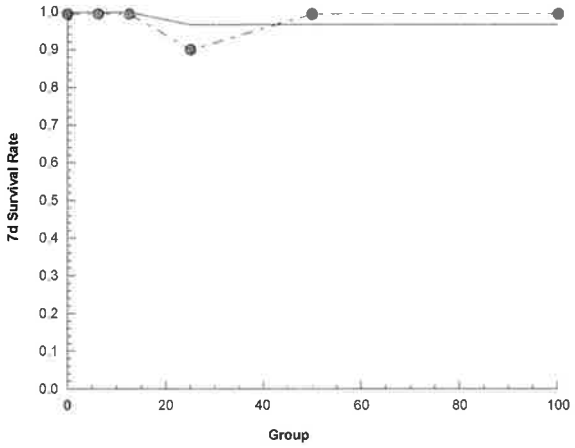
7d Survival Rate Binomials

Group	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	16-2778-8707	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Jul-19 10:15	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test

New England Bioassay

Analysis ID:	07-1350-6951	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Jul-19 10:16	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1
Batch ID:	10-0848-7679	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	09 Jul-19 11:25	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Receiving Water
Ending Date:	17 Jul-19 13:14	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Test Length:	8d 2h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	01-2346-1574	**Code:**	75BDFC6	**Project:**	
Sample Date:	08 Jul-19 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)
Receipt Date:	08 Jul-19 16:00	**CAS (PC):**		**Station:**	
Sample Age:	28h	**Client:**	New England Testing Labs		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	30739	200	Yes	Two-Point Interpolation

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	24.7	15	>>	Yes	Passes Criteria

Point Estimates

Level		95% LCL	95% UCL
IC25	>100	n/a	n/a
IC50	>100	n/a	n/a

Reproduction Summary

			Calculated Variate						Isotonic Variate	
Group	**Code**	**Count**	**Mean**	**Min**	**Max**	**Std Dev**	**CV%**	**%Effect**	**Mean**	**%Effect**
0	D	10	24.7	9	44	14	56.68%	0.0%	24.7	0.0%
6.25		10	19.6	5	34	9.501	48.47%	20.65%	23.26	5.83%
12.5		10	23	12	37	7.483	32.54%	6.88%	23.26	5.83%
25		10	24	14	33	6.074	25.31%	2.83%	23.26	5.83%
50		10	23.5	0	36	9.88	42.04%	4.86%	23.26	5.83%
100		10	26.2	14	35	6.143	23.45%	-6.07%	23.26	5.83%

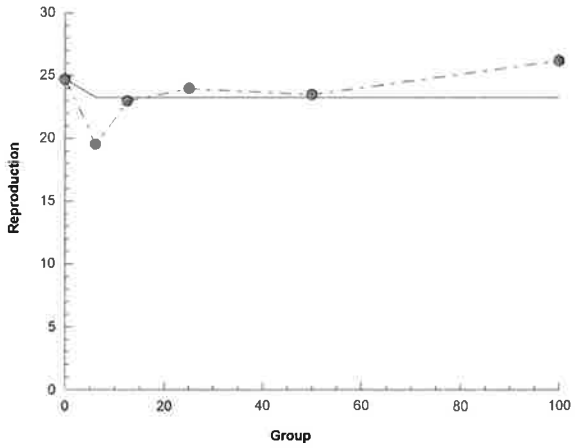
Reproduction Detail

Group	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	19	39	32	10	14	9	44	43	26	11
6.25		12	18	34	28	28	12	29	5	16	14
12.5		23	37	28	21	17	23	18	19	12	32
25		33	25	31	20	23	31	19	21	23	14
50		23	27	28	36	15	0	25	24	26	31
100		29	20	32	14	30	23	27	35	24	28

Ceriodaphnia 7-d Survival and Reproduction Test | **New England Bioassay**

Analysis ID:	07-1350-6951	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Jul-19 10:16	**Analysis:**	Linear Interpolation (ICPIN)	**Status Level:**	1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	16-8046-0191	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Jul-19 10:16	**Analysis:**	STP 2xK Contingency Tables	**Status Level:**	1
Batch ID:	10-0848-7679	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	09 Jul-19 11:25	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Receiving Water
Ending Date:	17 Jul-19 13:14	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Test Length:	8d 2h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	01-2346-1574	**Code:**	75BDFC6	**Project:**	
Sample Date:	08 Jul-19 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)
Receipt Date:	08 Jul-19 16:00	**CAS (PC):**		**Station:**	
Sample Age:	28h	**Client:**	New England Testing Labs		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	>100	n/a	

Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	1.0000	Exact	1.0000	Non-Significant Effect
		12.5	1.0000	Exact	1.0000	Non-Significant Effect
		25	0.5000	Exact	1.0000	Non-Significant Effect
		50	1.0000	Exact	1.0000	Non-Significant Effect
		100	1.0000	Exact	1.0000	Non-Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	1	0.8	>>	Yes	Passes Criteria

Data Summary

Group	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	D	10	0	10	1	0	0.0%
6.25		10	0	10	1	0	0.0%
12.5		10	0	10	1	0	0.0%
25		9	1	10	0.9	0.1	10.0%
50		10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

7d Survival Rate Detail

Group	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6.25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12.5		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

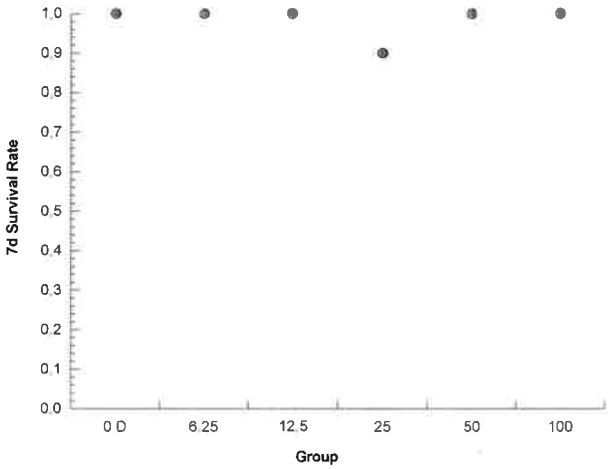
7d Survival Rate Binomials

Group	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
6.25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1
50		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test **New England Bioassay**

Analysis ID:	16-8046-0191	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Jul-19 10:16	**Analysis:**	STP 2xK Contingency Tables	**Status Level:**	1

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **New England Bioassay**

Analysis ID:	05-2414-2151	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Jul-19 10:16	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1
Batch ID:	10-0848-7679	**Test Type:**	Reproduction-Survival (7d)	**Analyst:**	
Start Date:	09 Jul-19 11:25	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Receiving Water
Ending Date:	17 Jul-19 13:14	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Test Length:	8d 2h	**Taxon:**	Branchiopoda	**Source:**	In-House Culture **Age:** <24
Sample ID:	01-2346-1574	**Code:**	75BDFC6	**Project:**	
Sample Date:	08 Jul-19 07:00	**Material:**	WWTF Effluent	**Source:**	Lowell RWWU (MA0100633)
Receipt Date:	08 Jul-19 16:00	**CAS (PC):**		**Station:**	
Sample Age:	28h	**Client:**	New England Testing Labs		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	>100	n/a		38.38%

Dunnett Multiple Comparison Test

Control	vs	Group	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Dilution Water		6.25	1.231	2.289	9.48	18	CDF	0.3167	Non-Significant Effect
		12.5	0.4105	2.289	9.48	18	CDF	0.6844	Non-Significant Effect
		25	0.169	2.289	9.48	18	CDF	0.7783	Non-Significant Effect
		50	0.2898	2.289	9.48	18	CDF	0.7334	Non-Significant Effect
		100	-0.3622	2.289	9.48	18	CDF	0.9190	Non-Significant Effect

Test Acceptability Criteria

		TAC Limits			
Attribute	**Test Stat**	**Lower**	**Upper**	**Overlap**	**Decision**
Control Resp	24.7	15	>>	Yes	Passes Criteria

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	244.4	48.88	5	0.57	0.7226	Non-Significant Effect
Error	4630.6	85.7519	54			
Total	4875		59			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	9.343	15.09	0.0961	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9931	0.9459	0.9830	Normal Distribution

Reproduction Summary

Group	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	D	10	24.7	14.68	34.72	22.5	9	44	4.427	56.68%	0.00%
6.25		10	19.6	12.8	26.4	17	5	34	3.004	48.47%	20.65%
12.5		10	23	17.65	28.35	22	12	37	2.366	32.54%	6.88%
25		10	24	19.66	28.34	23	14	33	1.921	25.31%	2.83%
50		10	23.5	16.43	30.57	25.5	0	36	3.124	42.04%	4.86%
100		10	26.2	21.81	30.59	27.5	14	35	1.943	23.45%	-6.07%

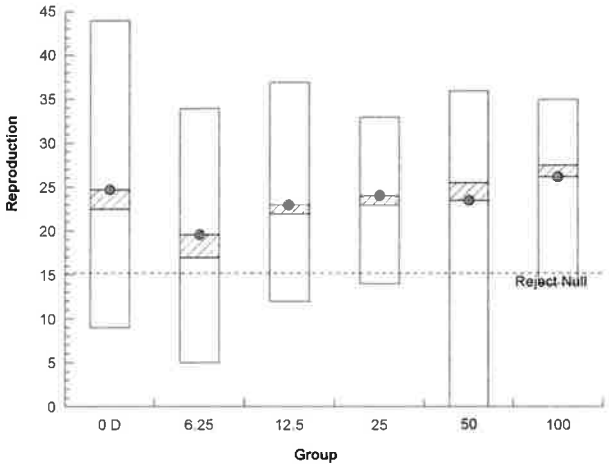
Reproduction Detail

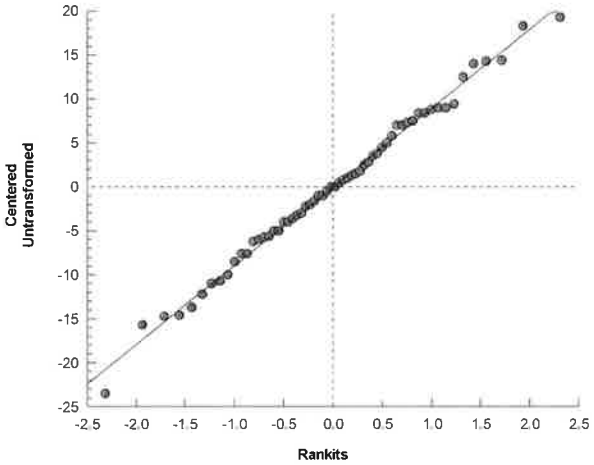
Group	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	D	19	39	32	10	14	9	44	43	26	11
6.25		12	18	34	28	28	12	29	5	16	14
12.5		23	37	28	21	17	23	18	19	12	32
25		33	25	31	20	23	31	19	21	23	14
50		23	27	28	36	15	0	25	24	26	31
100		29	20	32	14	30	23	27	35	24	28

Ceriodaphnia 7-d Survival and Reproduction Test **New England Bioassay**

Analysis ID:	05-2414-2151	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.4
Analyzed:	18 Jul-19 10:16	**Analysis:**	Parametric-Control vs Treatments	**Status Level:**	1

Graphics





NEB'S DATA SHEET FOR ROUTINE CHEMICAL AND PHYSICAL DETERMINATIONS

FACILITY NAME & ADDRESS:	Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850							
NEB PROJECT NUMBER:	05.0044476.00			TEST ORGANISM		*Ceriodaphnia dubia*		
DILUTION WATER SOURCE:	Laboratory Soft Water			START DATE:		7/9/19	TIME:	1125
ANALYST	KO	LS	BA	BA	BA	CH	KO	KO
NEB Lab Diluent	1	2	3	4	5	6	7	8
Temp °C Initial	25.2	25.0	25.3	25.6	25.2	25.9	25.7	25.4
D.O. mg/L Initial	8.4	8.2	8.1	8.1	8.1	8.0	8.2	8.2
pH s.u. Initial	7.2	7.5	7.7	7.5	7.6	7.6	7.6	7.5
Conductivity µS Initial	196	196	193	194	196	191	194	195
Temp °C Final	25.3	25.7	25.5	25.7	25.7	25.2	25.0	25.4
D.O. mg/L Final	7.7	8.0	7.7	8.1	7.9	8.1	8.3	6.6
pH s.u. Final	7.8	7.7	7.9	7.7	7.5	7.7	7.8	7.5
Conductivity µS Final	208	202	201	200	198	214	211	205
Merrimack River Control	1	2	3	4	5	6	7	8
Temp °C Initial	25.2	25.1	25.6	26.1	25.2	25.7	26.0	26.0
D.O. mg/L Initial	8.4	8.8	9.0	9.1	8.9	8.9	8.4	8.4
pH s.u. Initial	7.3	7.4	7.6	7.5	7.6	7.6	7.6	7.4
Conductivity µS Initial	171	168	180	180	182	180	182	183
Temp °C Final	25.3	25.7	25.6	25.3	25.7	26.3	25.2	25.6
D.O. mg/L Final	7.6	8.0	7.6	8.0	7.8	8.1	8.0	6.0
pH s.u. Final	7.8	7.8	7.9	7.6	7.5	7.5	7.9	7.3
Conductivity µS Final	184	180	187	189	186	191	194	191
6.25%	1	2	3	4	5	6	7	8
Temp °C Initial	25.6	25.0	25.4	26.1	25.3	25.9	26.0	26.0
D.O. mg/L Initial	8.4	8.2	8.2	8.1	8.1	8.3	8.3	8.7
pH s.u. Initial	7.3	7.5	7.6	7.5	7.6	7.5	7.5	7.3
Conductivity µS Initial	250	245	250	271	241	234	237	241
Temp °C Final	25.4	25.8	25.5	25.3	25.7	26.2	25.3	25.5
D.O. mg/L Final	7.6	7.9	7.6	7.9	7.8	8.0	7.7	6.5
pH s.u. Final	7.6	7.6	7.7	7.6	7.5	7.6	7.7	7.3
Conductivity µS Final	267	260	261	283	242	247	252	252
12.5%	1	2	3	4	5	6	7	8
Temp °C Initial	25.4	25.0	25.4	26.1	25.3	25.9	26.0	26.0
D.O. mg/L Initial	8.2	8.2	8.1	8.0	8.0	8.1	8.1	8.1
pH s.u. Initial	7.4	7.4	7.7	7.5	7.6	7.5	7.5	7.3
Conductivity µS Initial	295	289	337	340	286	278	274	287
Temp °C Final	25.4	25.8	25.4	25.3	25.6	26.1	25.3	25.5
D.O. mg/L Final	7.7	8.0	7.6	7.9	7.8	8.2	7.8	7.0
pH s.u. Final	7.7	7.6	7.7	7.6	7.5	7.6	7.7	7.4
Conductivity µS Final	308	301	344	348	286	290	285	295

NEB'S DATA SHEET FOR ROUTINE CHEMICAL AND PHYSICAL DETERMINATIONS

FACILITY NAME & ADDRESS:	Lowell Regional WW Utility, 1st Street Boulevard, Lowell MA 01850							
NEB PROJECT NUMBER:	05.0044476.00			TEST ORGANISM			*Ceriodaphnia dubia*	
DILUTION WATER SOURCE:	Laboratory Soft Water			START DATE:			7/9/19 TIME:	1125
25%	1	2	3	4	5	6	7	8
Temp °C Initial	25.3	24.9	25.5	26.2	25.3	25.9	26.0	26.0
D.O. mg/L Initial	8.2	8.2	8.2	8.1	8.1	8.0	8.0	8.0
pH s.u. Initial	7.5	7.6	7.6	7.5	7.5	7.4	7.5	7.3
Conductivity µS Initial	357	406	493	501	374	371	376	370
Temp °C Final	25.3	25.8	25.5	25.3	25.6	26.1	25.5	25.5
D.O. mg/L Final	7.8	8.0	7.7	7.9	7.8	8.2	7.8	7.3
pH s.u. Final	7.7	7.6	7.7	7.7	7.5	7.8	7.7	7.4
Conductivity µS Final	429	419	501	512	376	385	388	377
50%	1	2	3	4	5	6	7	8
Temp °C Initial	25.2	24.9	25.5	26.3	25.1	25.9	26.0	26.0
D.O. mg/L Initial	8.2	8.2	8.3	8.1	8.0	7.9	7.9	8.2
pH s.u. Initial	7.5	7.5	7.5	7.4	7.3	7.3	7.4	7.2
Conductivity µS Initial	629	621	796	804	543	549	544	555
Temp °C Final	25.3	25.8	25.4	25.3	25.7	26.1	25.3	25.5
D.O. mg/L Final	7.9	8.0	7.7	8.0	9.0	8.1	7.9	7.5
pH s.u. Final	7.7	7.6	7.8	7.8	7.6	7.7	7.7	7.5
Conductivity µS Final	655	642	806	819	552	574	569	564
100%	1	2	3	4	5	6	7	8
Temp °C Initial	25.3	24.8	25.8	26.6	25.1	25.9	26.0	26.0
D.O. mg/L Initial	8.2	8.3	8.7	8.4	8.1	7.7	7.6	8.3
pH s.u. Initial	7.4	7.4	7.4	7.3	7.1	7.0	7.2	7.0
Conductivity µS Initial	1,055	1,053	1,416	1,422	910	903	914	931
Temp °C Final	25.3	25.9	25.4	25.3	25.7	26.1	25.5	25.5
D.O. mg/L Final	7.8	7.9	7.6	8.0	7.6	8.3	7.8	7.5
pH s.u. Final	7.8	7.7	7.9	7.9	7.6	7.9	7.6	7.6
Conductivity µS Final	1,092	1,082	1,425	1,436	914	798	942	920

Table of Random Permutations of 16

C.dubia Test ID# 19-886

7	12	15	15	1	2	7	16	10	2	14	15	7	13	13	10	6	1	8	10
13	3	8	16	7	10	11	10	13	5	11	7	13	16	7	7	5	13	2	14
3	1	4	5	14	13	3	14	9	13	13	2	9	15	6	2	8	4	5	8
11	8	16	14	15	6	2	6	2	16	8	5	12	3	9	13	4	3	10	4
14	9	1	6	3	9	14	13	8	6	5	8	14	7	3	15	13	11	4	7
2	16	10	13	5	5	13	2	11	7	3	12	5	14	12	16	2	2	9	15
4	6	13	7	2	15	1	9	1	4	7	10	6	9	11	9	7	6	16	11
6	14	6	10	4	14	4	15	3	3	4	16	2	6	5	1	12	10	6	9
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12	10	7	12	9	11	9	8	12	14	15	4	11	8	16	8	9	14	14	1
15	7	5	2	10	7	8	12	6	15	6	13	16	12	15	4	11	8	12	6
16	2	11	8	8	8	15	5	16	1	1	9	8	1	8	14	16	5	13	5
9	13	14	3	6	4	10	11	5	12	9	3	10	4	4	3	10	9	1	3
8	11	9	4	11	3	12	7	7	10	12	14	3	10	1	6	15	16	15	12
1	5	12	11	16	16	5	4	14	9	16	11	1	2	10	5	1	15	7	13
5	4	3	9	12	1	6	1	15	11	2	6	4	11	2	11	3	7	11	16
										conc									
11	8	16	5	5	13	1	13	2	16	14	12	9	8	7	5	13	3	13	3
2	2	8	8	14	16	4	3	8	11	10	14	15	1	2	11	4	5	15	9
6	13	2	13	6	5	9	15	11	10	12	6	16	15	16	9	10	12	16	15
14	12	4	16	16	11	14	10	5	12	3	3	12	14	15	13	6	4	1	16
8	6	3	9	4	10	6	4	16	2	2	9	8	16	4	6	5	15	7	8
9	15	12	10	3	2	12	6	1	15	4	13	7	7	9	12	14	8	8	11
3	10	11	12	13	12	5	11	7	8	9	5	14	11	10	1	3	13	3	5
16	1	13	14	8	14	15	5	3	7	11	15	6	12	5	7	11	1	14	4
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12	7	15	15	15	9	8	12	12	13	15	10	1	4	6	16	2	6	11	1
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1	6	7	4	8	6	5	2	8	15	4	6	6	1	4	5	7	13	2	10
9	15	11	3	11	15	9	10	1	3	8	2	15	7	9	8	16	1	14	3
10	16	4	5	12	9	16	11	7	1	7	16	11	8	3	3	12	2	3	4
4	14	1	9	5	5	4	13	6	8	15	5	12	5	7	16	5	11	8	1
7	3	13	14	15	2	1	14	16	5	14	9	2	16	1	12	6	14	4	13
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13	12	5	11	3	11	15	8	2	7	11	7	8	14	6	4	4	4	15	11
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2	7	6	2	1	8	10	6	15	12	1	11	7	11	13	6	1	15	13	15
6	4	15	8	16	10	14	16	9	6	12	3	10	6	14	7	2	12	16	7
5	8	12	15	7	3	12	5	12	9	5	15	1	13	15	13	15	5	1	2
									rep										
13	4	10	4	16	13	16	13	5	3	6	14	1	16	8	7	2	3	3	12
5	14	4	6	8	2	15	1	13	14	16	4	15	4	3	12	12	1	4	7
2	2	2	15	14	16	9	12	16	6	10	15	14	9	10	1	14	8	8	16
7	12	15	8	12	3	5	14	7	12	5	13	16	1	7	5	11	2	9	3
6	9	7	14	9	14	10	11	15	11	12	1	12	12	14	16	3	11	11	8
14	5	16	7	10	8	11	8	14	13	7	11	6	3	11	4	4	6	6	9
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11	6	6	1	4	1	3	16	12	5	4	9	13	13	6	8	15	9	1	14
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1	8	1	13	1	15	4	4	11	4	2	16	5	8	1	9	5	12	16	6
9	7	14	2	6	4	14	10	9	8	15	10	7	10	9	10	6	14	10	11
12	1	9	10	15	5	2	15	10	2	14	2	8	2	4	13	8	5	15	5
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10	15	11	5	13	7	12	5	2	7	11	5	10	15	12	3	1	13	13	10
8	13	13	3	3	10	13	2	4	1	8	6	11	14	15	6	9	16	2	2
16	16	5	12	11	6	1	3	8	16	3	7	2	5	16	14	13	7	14	15

Ceriodaphnia dubia Culture Chart Lot # Cal9(RMH 142) B

Brood mother source: 135 S B.4 Source's brood size: 23 (Qty.) Lowell 7-9-19

Tech	AH	KF	SP	ML		AH	AH	KF								
Date	7.2	7.3	7.4	7.5		7.7	7.8	7.9								
Day acc.	0	1	2	3	4	5	6	7		8	9	10	11	12	13	14
Cup # 1	N	N	2	5		2Y	N	T1 Y25	1							
2	N	N	2	5		2Y	N	T2 T2 Y24	2							
3	N	N	2	4		2Y	N	T3 T3 Y19	3							
4	N	N	2	5		2Y	N	T4 T4 Y23	4							
5	N	N	2	5		2Y	N	T5 T5 Y24	5							
6	N	N	2	5		2Y	N	T6 T6 Y24	6							
7	N	N	2	4		2Y	N	T7 T7 Y21	7							
8	N	N	2	6		2Y	N	T8 T8 Y24	8							
9	N	N	2	6		2Y	N	Y	9							
10	N	N	2	5		2Y	N	T9 T9 Y20	10							
11	N	N	2	5		2Y	N	T10 T10 Y19	11							
12	N	N	2	5		2Y	N	T9 Y21	12							
13	N	N	2	4		2Y	N	T10 Y23	13							

Y = neonates present, and *criterion has been met:* ≥ 20 neonates produced in total by 3rd brood. **N** = no neonates

2B = two broods present. **2Y** = two broods and criterion met: ≥ 20 neos. by 3rd brood. **X** = brood mother dead **ae** = aborted eggs

✓ or **P** = neonates present after renewal on previous day (see time in log). **A→** = acceptable for acute testing only

T# = neonates used in test, replicate number of test noted (and brood counted). **acc.** = *if acclimated*, H_2O type used w/ renewal **this** day.

Test organism collection:

Project #	Symbols (✓ / P)	Tray diagram used? (Y/N)	Time period, neonates released	Collection date / time
0044474	T	Y	7.8.19/1455 → 7.8.19/1710	7.9.19/0935
0044476	T	Y	7.8.19/1455 → 7.8.19/1710	7.9.19/0955
05616466	T	Y	7.8.19/1630 → 7.8.19/1710	7.9.19/1030
	T			
	T			
	T			

SAMPLE RECEIPT CHEMISTRY
&
CHAIN OF CUSTODY DOCUMENTS

NEW ENGLAND BIOASSAY - INITIAL CHEMISTRY DATA

PERMITTEE: Lowell RWWU

NEB JOB # 05.0044476.00

DATE RECEIVED	7/8/19		7/10/19		7/12/19	
SAMPLE TYPE:	EFF #1	RIVER #1	EFF #2	RIVER #2	EFF #3	RIVER #3
COC #	C39-2558	C39-2559	C39-2609	C39-2610	C39-2664	C39-2665
pH (SU)	7.0	7.1	7.2	7.4	6.6	6.7
Temperature (°C)	10.6	6.6	6.7	6.4	5.3	7.0
Dissolved Oxygen (mg/L)	9.3	9.2	9.4	9.6	9.1	9.3
Conductivity (µmhos)	1,081	171	1,433	178	943	183
Salinity (ppt)	< 1	< 1	<1	<1	< 1	< 1
TRC - DPD (mg/L)	0.002	0.020	0.012	0.014	0.016	0.037
TRC - Amperometric (mg/L)	N/A	N/A	N/A	N/A	N/A	N/A
Hardness (mg/L as $CaCO_3$)	82	20	122	24	76	24
Alkalinity (mg/l as $CaCO_3$)	80	15	80	10	50	15
Tech Initials	CW	CW	KO	KO	CW	CW

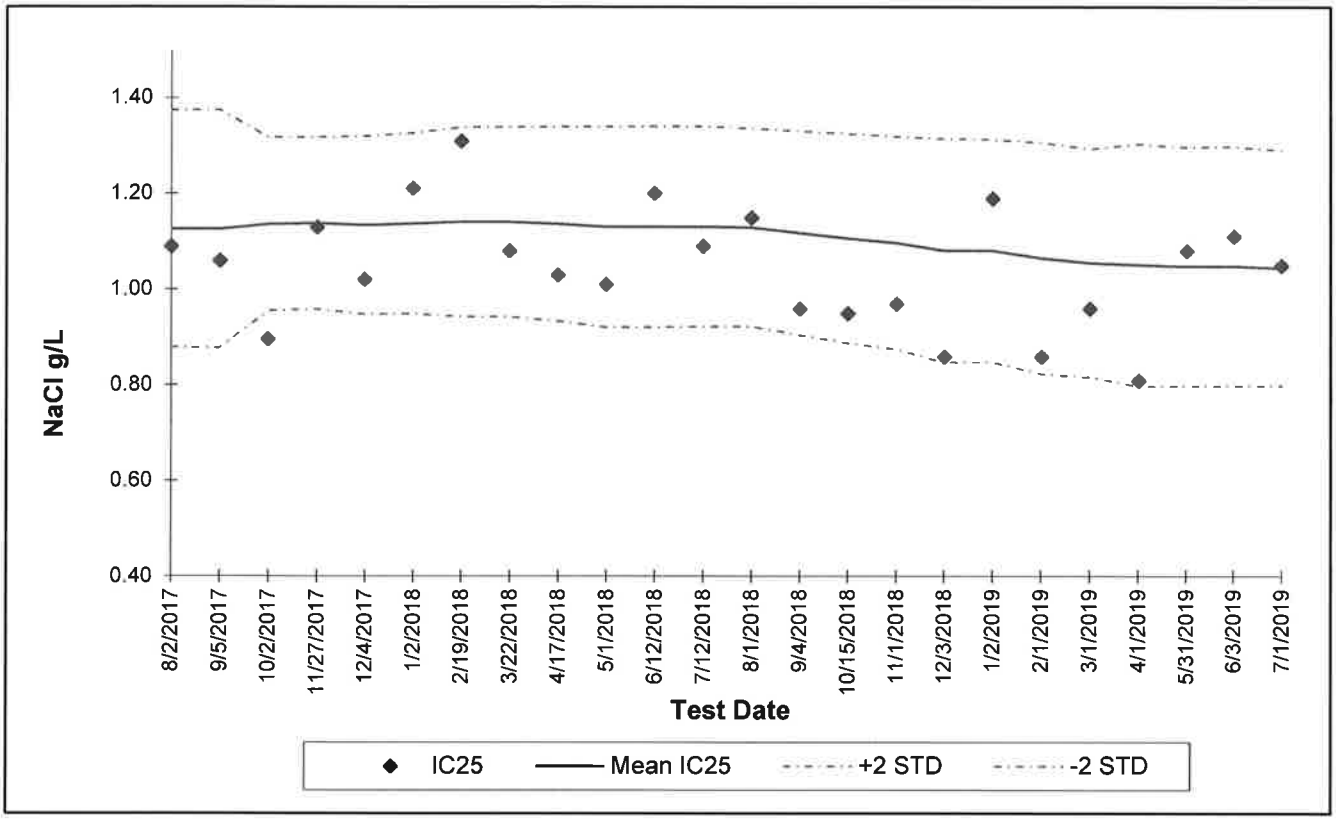
NOTE: NA = NOT APPLICABLE

Data Reviewed By: _____ Date Reviewed: 8/15/19

REFERENCE TOXICANT CHARTS

New England Bioassay

Reference Toxicant Data: Sodium chloride (NaCl) *Ceriodaphia dubia* Chronic Reproduction IC_{25}



Test ID	Date	IC_{25}	Mean IC_{25}	STD	-2STD	+2STD	Avg. CV	Repro PMSD (%)	Avg. PMSD (%)
17-1146	8/2/2017	1.09	1.13	0.12	0.88	1.38	0.11	23.94	15.20
17-1317	9/5/2017	1.06	1.13	0.12	0.88	1.38	0.11	33.78	16.13
17-1516	10/2/2017	0.90	1.14	0.09	0.95	1.32	0.08	24.47	16.53
17-1787	11/27/2017	1.13	1.14	0.09	0.96	1.32	0.08	19.97	16.69
17-1846	12/4/2017	1.02	1.13	0.09	0.95	1.32	0.08	14.69	16.60
18-10	1/2/2018	1.21	1.14	0.09	0.95	1.33	0.08	10.81	16.36
18-271	2/19/2018	1.31	1.14	0.10	0.94	1.34	0.09	22.90	16.56
18-416	3/22/2018	1.08	1.14	0.10	0.94	1.34	0.09	17.59	16.88
18-553	4/17/2018	1.03	1.14	0.10	0.93	1.34	0.09	38.54	17.77
18-607	5/1/2018	1.01	1.13	0.10	0.92	1.34	0.09	24.65	18.25
18-816	6/12/2018	1.20	1.13	0.11	0.92	1.34	0.09	46.97	19.59
18-996	7/12/2018	1.09	1.13	0.10	0.92	1.34	0.09	11.41	19.70
18-1103	8/1/2018	1.15	1.13	0.10	0.92	1.34	0.09	17.23	19.67
18-1315	9/4/2018	0.96	1.12	0.11	0.91	1.33	0.10	22.12	20.09
18-1577	10/15/2018	0.95	1.11	0.11	0.89	1.33	0.10	24.32	20.64
18-1625	11/1/2018	0.97	1.10	0.11	0.88	1.32	0.10	31.57	21.34
18-1756	12/3/2018	0.86	1.08	0.12	0.85	1.32	0.11	15.77	21.00
19-8	1/2/2019	1.19	1.08	0.12	0.85	1.31	0.11	40.72	21.30
19-177	2/1/2019	0.86	1.07	0.12	0.82	1.31	0.11	18.71	21.63
19-265	3/1/2019	0.96	1.06	0.12	0.82	1.29	0.11	19.84	22.13
19-403	4/1/2019	0.81	1.05	0.13	0.80	1.30	0.12	10.09	21.85
19-674	5/31/2019	1.08	1.05	0.12	0.80	1.30	0.12	15.59	21.93
19-688	6/3/2019	1.11	1.05	0.12	0.80	1.30	0.12	15.24	22.23
19-926	7/1/2019	1.05	1.04	0.12	0.80	1.29	0.12	12.60	22.23

National 75th Percentile and 90th Percentile CV Averages for Ceriodaphnia Reproduction IC25 (EPA 833-R-00-003): 0.45 - 0.62
PMSD Upper and Lower Bounds for Ceriodaphnia Reproduction (EPA-821-R-02-013): 13% - 47%

Results:

Sample: Effluent Day 1
9G08023-01 (Water)

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO3	**76**	2	mg/L	07/15/19
Ammonia	**3.8**	0.1	mg/L	07/11/19
pH	**7.2**	0.1	SU	07/08/19 17:30
Specific Conductance	**974**	2	uS/cm	07/10/19
Total Dissolved Solids	**452**	10	mg/L	07/09/19
Total Organic Carbon	**9.4**	0.2	mg/L	07/12/19
Total solids (TS)	**596**	10	mg/L	07/12/19
Total Suspended Solids	**19**	2	mg/L	07/11/19

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	**24.6**	0.05	mg/L	07/10/19
Magnesium	**5.13**	0.05	mg/L	07/10/19
Aluminum	**0.032**	0.001	mg/l	07/16/19
Cadmium	ND	0.0001	mg/L	07/16/19
Copper	**0.006**	0.001	mg/l	07/16/19
Nickel	**0.003**	0.001	mg/l	07/16/19
Lead	**0.0008**	0.0001	mg/L	07/16/19
Zinc	**0.060**	0.001	mg/l	07/16/19
Total Hardness	**82.5**	0.125	mg/L	07/10/19

Sample: Merrimack River Day 1
9G08023-02 (Water)

General Chemistry

	Result	Reporting Limit	Units	Date Analyzed
Alkalinity as CaCO3	**12**	2	mg/L	07/15/19
Ammonia	**0.2**	0.1	mg/L	07/11/19
pH	**7.1**	0.1	SU	07/08/19 17:30
Specific Conductance	**154**	2	uS/cm	07/10/19
Total Dissolved Solids	ND	10	mg/L	07/09/19
Total Organic Carbon	**4.4**	0.2	mg/L	07/12/19
Total solids (TS)	**104**	10	mg/L	07/12/19
Total Suspended Solids	**5**	2	mg/L	07/11/19

Sample: Merrimack River Day 1 (Continued)
9G08023-02 (Water)

Total Metals

	Result	Reporting Limit	Units	Date Analyzed
Calcium	**6.24**	0.05	mg/L	07/10/19
Magnesium	**1.25**	0.05	mg/L	07/10/19
Aluminum	**0.050**	0.001	mg/l	07/09/19
Cadmium	ND	0.0001	mg/L	07/09/19
Copper	**0.001**	0.001	mg/l	07/09/19
Nickel	ND	0.001	mg/l	07/09/19
Lead	**0.0004**	0.0001	mg/L	07/09/19
Zinc	**0.008**	0.001	mg/l	07/09/19
Total Hardness	**20.7**	0.125	mg/L	07/10/19

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

Sample Set #1

EFFLUENT

Sampler: JIN BOK McGOWAN
Title: CHEMIST
Facility: Lowell Regional Wastewater Utilities

Sampling Method: X **Composite**
Sample ID:
Start Date: 7/7/19 Time: 7:00 AM
End Date: 7/8/19 Time: 7:00 AM

Sampling Method: _____ **Grab** (for pH and TRC only_____)
Date Collected:
Time Collected:

Sample Type:
_____ Prechlorinated
X Dechlorinated
_____ Unchlorinated
_____ Chlorinated

RECEIVING WATER

Sampler: Aaron FOX
Title: O/S Supervisor
Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Grab
Sample ID: Merrimack River
Date Collected: 7/8/2019 9:30AM
Time Collected:

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: X Chronic and modified acute

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By:	Shea	Date: 7-8-2019	Time: 12:05 pm
Received By:	BFacheco	Date: 7-8-19	Time: 1205
Relinquished By:	BFacheco	Date: 7-8-19	Time: 1440
Received By:	[illegible]	Date: 7/8/19	Time: 1440
Relinquished By:	[illegible]	Date: 7/8/19	Time: 4:00
Received By:	[illegible]	Date: 7/8/19	Time: 11:00

FOR NEB USE ONLY

*** Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory ***

Temperature of Effluent Upon Receipt at Lab: 10.6 °C
Temperature of Receiving Water Upon Receipt at Lab: 6.6 °C

Effluent COC# C39-2558
Receiving Water COC# C39-2559

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

Sample Set #2

EFFLUENT

Sampler: SIN BOK M [illegible]

Title: CHEMIST

Facility: Lowell Regional Wastewater Utilities

Sampling Method: X **Composite**

Sample ID:

Start Date: 7/9/17 Time: 9:00 AM

End Date: 7/10/17 Time: 9:00 AM

Sampling Method: _____ **Grab** (for pH and TRC only_____)

Date Collected:

Time Collected:

RECEIVING WATER

Sampler: Aaron Fox

Title: ops. supervisor

Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Grab

Sample ID: Merrimack River

Date Collected: 7/10/2017 8:30AM

Time Collected:

Sample Type:

_____ Prechlorinated
X Dechlorinated
_____ Unchlorinated
_____ Chlorinated

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: X Chronic and modified acute

Received ON ICE

Sample Shipment

Method of Shipment: New England Testing Labs

Relinquished By:		Date: 7-10-17	Time: 11:30
Received By:	B Richer	Date: 7/10/17	Time: 1130
Relinquished By:	B Pacheco	Date: 7/10/17	Time: 1515
Received By:	[illegible]	Date: 7-10-17	Time: 1515
Relinquished By:	[illegible]	Date: 7-10-17	Time: 1615
Received By:	[illegible]	Date: 7/10/17	Time: 1615

FOR NEB USE ONLY

*** Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory ***

Temperature of Effluent Upon Receipt at Lab: 6.7 °C

Temperature of Receiving Water Upon Receipt at Lab: 6.4 °C

Effluent COC# C39-2609

Receiving Water COC# C39-2610

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042

NEW ENGLAND BIOASSAY CHAIN-OF-CUSTODY

Sample Set #3

EFFLUENT

Sampler: Jin Bok McQok

Title: Chemist

Facility: Lowell Regional Wastewater Utilities

Sampling Method: X **Composite**

Sample ID:

Start Date: 7/11/19 Time: 7:00 Am

End Date: 7/12/19 Time: 7:00 Am

Sampling Method: ____ **Grab** (for pH and TRC only____)

Date Collected:

Time Collected:

Sample Type:

- ____ Prechlorinated
- X Dechlorinated
- ____ Unchlorinated
- ____ Chlorinated

RECEIVING WATER

Sampler: Aaron Fox

Title: Ops. Supervisor

Facility: Lowell Regional Wastewater Utilities

Sampling Method: X Grab

Sample ID: Merrimack River

Date Collected: 7/12/19

Time Collected:

Received ON ICE

Effluent Sampling Location and Procedures: Plant outfall after dechlorination. 24 hr. composite.

Receiving Water Sampling Location and Procedures: Merrimack River upstream of the plant discharge at the Hunts Fall Bridge, (Rt.38)

Requested Analysis: X Chronic and modified acute

Sample Shipment

Method of Shipment: New England Testing Labs

		Date	Time
Relinquished By:	[signature]	7-12-19	11:30 Am
Received By:	[signature]	7/12/19	1130
Relinquished By:	[signature]	7/12/18	1510
Received By:	[signature]	7/12/18	1515
Relinquished By:	[signature]	7/12/18	1610
Received By:	[signature]	7/12/19	1610

FOR NEB USE ONLY

*** Please return all ice packs NEB has provided to insure accurate temperature upon receipt to the NEB laboratory ***

Temperature of Effluent Upon Receipt at Lab: 5.3 °C

Temperature of Receiving Water Upon Receipt at Lab: 7.0 °C

Effluent COC# C39-2664

Receiving Water COC# C39-2665

IF THIS COOLER IS MISPLACED OR THE LABEL IS LOST, PLEASE SHIP TO:
KIM WILLS, NEW ENGLAND BIOASSAY, 77 BATSON DRIVE, MANCHESTER CT 06042